An Interdisciplinary Analysis of Multispectral Satellite Data for Selected Cover Types in the Colorado Mountains, Using Automatic Data Processing Techniques

EREP S398

Monthly Progress Report for April, 1974

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MONTHLY PROGRESS REPORT
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A. Overall Status and Progress to Date

A.1 The SL-2 S-192 data has been reformatted Bulk-to-LARSYS. Photographs of the data, every other line and column are being sent under separate cover.

A.2 SNOW AVALANCHE HAZARD MAPPING USING SKYLAB IMAGERY

Skylab imagery obtained on June 5, 1973, and August 8, 1973 were used in a first attempt to assess the feasibility of mapping avalanche hazard. The imagery used included wavelengths of .4 to .5μ, .5 to .6μ, .7 to .8μ and .8 to .9μ color positive and color IR. The shorter wavelengths (.4 to .6μ) were useless for avalanche identification, but the longer wavelength imagery (.7 to .9μ) and color photos could be used equally well. The scale of the imagery was approximately $1:2 \times 10^6$.

The Baush & Lomb "Zoom-Transfer" scope, the Spatial Data Systems Color Inhancer, and 5, 10, and 17 power handlens were used in the mapping project. The Color Inhancer was useless, the Zoom Transfer of limited use and the handlens quite useful. Magnification of the imagery maintained resolution up to about 1:60,000, but magnification beyond this point produced no additional information.

The area chosen for analysis is mapped on the USGS topographic quadrangle "Silverton, 1955". Familiarity with this area by the users of this imagery may have aided in the identification of avalanche areas, but it is difficult to assess. A morphologic map of the Silverton area is also available for the Silverton quadrangle. This morphologic mapping was done using low altitude air photography and by field checking during the summers of 1971 and 1972, thus representing a "ground truth" base with which it is possible to compare the Skylab-derived maps.

The accuracy and utility of this mapping technique is best demonstrated by comparing the Skylab map with the morphological map which represents the ground truth.

Major avalanche tracks (those exceeding ∿50 m in width) were visible in most cases on the June (SL-2) imagery because the snow cover in the tracks contrasted sharply with the dark green conifer forest. The SL-3 imagery (August, 1973) did not have this contrast; consequently, mapping was more difficult (see prototype map for comparison). A valid comparison between the June and August imagery was not possible because of the increased cloud cover during the August pass.

Mapping of major avalanche paths can be accomplished using Skylab Imagery of a scale of $\sim 1:2 \times 10^6$ using a light table and hand lens if the avalanche tracks are filled with snow, producing contrast with the surrounding forest.

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It should not be suggested that this technique can be used to map any avalanches other than the major tracks, although it does provide a general idea of where avalanche areas occur.

A.3 Structural mapping on Mission 247 underflight photography (4 Aug 1973) is currently in progress. The scanner data from this mission is being prepared for enhancement, i.e., ratioing and directional cosines. Both of these analyses will then be compared to the SKYLAB analyses of photography and scanner data.

B. Recommendations

None

C. Expected Accomplishments

Mapping on the SL-3 and Mission 247 photography will continue as will analysis of the 24 channel scanner data. Rock samples that were collected during August of 1973 have been analyzed with the Exotech. This data will then be digitized and reformatted to compare with the S-192 data.

D. Significant Results

The S-190A and S-190B photography from SL-2 and SL-3 has been analyzed by manual interpretation by INSTAAR personnel. The following report summarizes their conclusions.

E. Summary Outlook

Funding for this project will be exhausted during July, 1974, which is sooner than expected. Computing costs will have to be taken from personnel and S & E funds after May 31 when the current S R & T grant ends. This S R & T grant has previously covered all EREP computing costs at LARS. The new S R & T contract does not contain funding for EREP computing. Therefore, a cost-extension proposal, which will include computing costs, will be submitted in early June, 1974.

F. Travel

No travel funds were expended during this reporting period.

SKYLAB-EXAMINATION OF IMAGERY (1)

Date	Sensor	Type	Overall Contrast	Resolution	Color	Manual Interpretation with Hand Lens
6/5/73	S190A	.5-.6	Good	Good, roads & streams visible	--	1) Good separation of irrigated fields from arid shrub and grasslands. 2) Poor separation of irrigated fields and forest 3) Poor separation of deciduous from coniferous forest 4) Good distinction of land use classes 5) Fair distinction of land use classes 6) Large avalanche tracks visible 7) Clear cut areas visible due to more complete snow cover 8) Good discrimination of water bodies 9) Excellent discrimination of snow edge 10) Much snow obscuring tundra

Date	Sensor	Type	Overall Contrast	Resolution	Color	Manual Interpretation with Hand Lens
6/5/73	S190A	.6-.7	Excellent	Good, roads very clear	--	1) Excellent separation of irrigated fields from arid shrub & grasslands 2) Fair separation of irrigated fields from sparce forest 3) Poor separation of irrigated fields and dense forest 4) Poor separation of coniferous and deciduous forest 5) Excellent distinction of land form classes 6) Good separation of land use classes in arid areas.

Date	Sensor	Type	Overall Contrast	Resolution	Color	Manual Interpretation with Hand Lens
(continued from page 1)						7) Large avalanche tracks visible 8) Fair discrimination of water bodies 9) Excellent discrimination of snow edge 10) Much snow obscuring tundra
6/5/73	S190A	.7-.8	Fair except for good on lakes & snow	Poor	--	1) Fair-good separation of irrigated fields from arid shrub and grasslands 2) Good-excellent separation irrigated fields from sparce and dense forest 3) Poor separation of deciduous from coniferous forest 4) Poor-fair separation of all landforms classes 5) Poor-fair separation of land use classes 6) Avalanche tracks largely indistinguishable 7) Clear cut areas largely indistinguishable 8) Excellent discrimination of water bodies 9) Fair discrimination of snow edge 10) Much snow obscuring tundra

Date	Sensor	Type	Overall Contrast	Resolution	Color	Manual Interpretation with Hand Lens
6/5/73	S190A	.8-.9	Good-excellent on lakes & snow	Poor-very grainy-more like ERTS	--	1) Good-excellent separation of irrigated fields from arid shrub and grasslands 2) Good-excellent separation of irrigated fields from forests 3) Poor separation of deciduous from coniferous forests 4) Poor-fair separation of all land form classes 5) Fair separation of land use classes 6) Avalanche tracks largely indistinguishable 7) Clear cut areas largely indistinguishable 8) Excellent discrimination of water bodies 9) Fair discrimination of snow edge 10) Much snow obscuring tundra

Date	Sensor	Type	Overall Contrast	Resolution	Color	Manual Interpretation with Hand Lens
6/5/73	S190A	Color	Good-excellent	Excellent	Good	1) Good separation of irrigated fields from arid shrub and grasslands 2) Fair-good separation of irrigated fields from forests 3) Poor separation of deciduous from coniferous forest 4) Excellent separation of land form classes 5) Good-excellent separation of land use classes 6) Large avalanche tracks visible 7) Clear cut areas visible

Date	Sensor	Type	Overall Contrast	Resolution	Color	Manual Interpretation with Hand Lens
(Continued from page 3)						8) Good discrimination of water bodies 9) Excellent discrimination of snow edge 10) Much snow obscuring tundra
6/5/73	S190A	CIR	Excellent	Excellent	Good	1) Excellent separation of irrigated fields from arid shrub and grasslands 2) Good-excellent separation of irrigated fields from forests 3) Poor-fair separation of deciduous from coniferous forest 4) Excellent separation of land form classes 5) Excellent separation of land use classes 6) Large avalanche tracks visible 7) Clear cut areas visible 8) Excellent discrimination of water bodies 9) Excellent discrimination of snow edge 10) Much snow obscuring tundra
6/5/73	S190B	Color	Excellent	Excellent, many roads and some buildings appear to be visible on this larger scale	Good-excellent	1) Excellent separation of irrigated fields and arid shrub and grasslands 2) Excellent separation of irrigated fields and forests 3) Some minor separation of deciduous from coniferous forest

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
6/5/73						4) Excellent separation of land form classes
	(Continued from page 4)					5) Excellent separation of land use classes
						6) Large and moderate size avalanche tracks visable
						7) Clear cut areas very clear
						8) Good-excellent discrimination of water bodies
						9) Excellent discrimination of snow edge
						10) Much snow obscuring tundra

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73	S190A	.5-.6	Poor, appears under exposed in some frames	Excellent	--	1) Good-excellent separation of irrigated fields from arid shrub and grasslands where exposure is adequate
						2) Poor separation of irrigated fields and forest
						3) Poor separation of deciduous from coniferous forest
						4) Fair-good distinction of land form classes
						5) Fair-good distinction of land use classes
						6) Exposure poor for avalanche track recognition
						7) Poor exposure for clearcut area examination
						8) Poor exposure for water body discrimination
						9) Some confusion due to similarity of cloud and snow
						10) Clouds and cloud shadow some obscure mountain areas.

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73	S190A	.6-.7	Good	Excellent	--	1) Fair-good separation of irrigated fields from arid shrub and grassland 2) Poor separation of irrigated fields from forests 3) Poor separation of deciduous from coniferous forest 4) Good-excellent distinction of land form classes 5) Poor-good distinction of land use classes 6) Some large avalanche tracks visible 7) Fair-good clear cut area discrimination 8) Fair-good discrimination of water bodies 9) Excellent discrimination of snow edge 10) Cloud and cloud shadow obscure some mountain areas

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73	S190A	.7-.8	Excellent	Fair-Good	--	1) Good separation of irrigated fields from arid shrub & grasslands 2) Good separation of irrigated fields from forest 3) Fair separation of deciduous from coniferous forest 4) Good-excellent discrimination of land form classes 5) Good-excellent discrimination of land use classes

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73						6) Some large avalanche tracks visible
			(Continued from page 6)			7) Some clear cut areas visible
						8) Excellent discrimination of water bodies
						9) Fair discrimination of snow edge
						10) Cloud and cloud shadow obscure some mountain areas

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73	S190A	.8-.9	Good	Good	--	1) Good-excellent separation of irrigated fields from arid shrub and grass land
						2) Good-excellent separation of irrigated fields from forests
						3) Fair-good separation of deciduous from coniferous forest
						4) Good-excellent distinction of land form classes
						5) Good-excellent distinction of land use classes
						6) Large avalanche tracks visible
						7) Some clear cut areas visible
						8) Excellent discrimination of water bodies
						9) Poor discrimination of snow edge
						10) Cloud and cloud shadow obscure some mountain areas

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73	S190A	Color	Poor-good appears underexposed in some frames	Excellent	Fair in some frames	1) Fair separation of irrigated fields from arid shrub and grass lands where exposure permits examination

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73						2) Poor separation of irrigated fields from forests
			(Continued from page 7)			3) Poor separation of deciduous from coniferous at least partly due to exposure
						4) Fair distinction of land form classes
						5) Fair distinction of land use classes
						6) Few avalanche tracks visible due to poor exposure
						7) Few clear cut areas visible due to poor exposure
						8) Poor discrimination of water bodies
						9) Good discrimination of snow edge but few recognizable land forms for easy location
						10) Cloud and cloud shadow obscure some mountain areas

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73	S190A	CIR	Fair-excellent appears underexposed in some frames	excellent	fair-good	1) Excellent separation of irrigated fields from arid shrub and grass lands
						2) Fair-excellent separation of irrigated fields from forest
						3) Fair separation of deciduous from coniferous forest
						4) Good-excellent discrimination of land form classes
						5) Fair-excellent discrimination of land use classes
						6) Some large avalanche tracks visible
						7) Good-excellent visibility of clear cut areas

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73						8) Good-excellent discrimination of water bodies
			(Continued from page 8)			9) Good-excellent discrimination of snow edge
						10) Clouds and cloud shadow obscure some mountain areas

Date	Sensor	Type	Contrast	Resolution	Color	Manual Interpretation with Hand Lens
8/8/73	S190A	Color	Good, appears under exposed in some frames	excellent some buildings and many roads appear to be visible on this larger scale	Good	1) Good-excellent separation of irrigated fields from arid shrub and grasslands
						2) Good separation of irrigated fields from forests
						3) Poor separation of deciduous from coniferous forest
						4) Good-excellent discrimination of land form classes
						5) Good-excellent discrimination of land use classes
						6) Large and moderate avalanche tracks visible
						7) Good visibility of clear cut areas
						8) Fair discrimination of water bodies
						9) Excellent discrimination of snow edge
						10) Much snow obscuring tundra